

GEAR PUMP, ESPECIALLY FOR MEDICAL PURPOSES

The invention relates to a gear pump, especially for medical purposes.

Gear pumps are used in medicine for example in the field of dialysis. A gear pump according to the preamble, used inter alia in this field of medicine, comprises a pump housing having a base plate, a cover plate and a housing center portion arranged therebetween. In the pump chamber of the housing center portion at least two pump wheels are disposed which in the case of the gear pump according to the preamble consist of a special steel such as Waukesha 88. The pump wheels are mounted on rotating shafts and on the shaft of the driving pump wheel, which is in engagement with the driven pump wheel, a magnet is mounted which forms a part of a magnetic coupling for transmitting the drive forces to the shaft of the driven pump wheel. Both the shafts of the pump wheels and their bearing bushes for mounting in the pump housing consist in the gear pump according to the preamble of a high-strength steel, for example Widia steel, to ensure proper guiding of the pump wheels and their shafts, which sometimes rotate at very high speed.

However, a disadvantage is that the gear pump according to the preamble because of the expensive materials used and the complex production, in particular as regards the mounting of the rotating shafts of the pump wheels, is very costly to manufacture.

Furthermore, the gear pump according to the preamble has the serious disadvantage that in spite of the use of expensive materials which are considered wear-resistant in a considerable number of gear pumps used in particular in medicine after a relatively short operating time considerable wear occurs, in particular in the region of the shafts of the pump wheels and their bearings in the pump housing. As investigation carried out within the scope of the invention has shown this wear is due to material decompositions of the bearings and shafts due to the use of aggressive cleaning agents such as acetic acid. Since however a cleaning of the gear pumps in particular in the field of dialysis with such aggressive cleaning agents is essential for reasons of hygiene the gear pump according to the invention is not very suitable for use in medicine because in spite of employing expensive materials it has proved prone to wear and trouble.

The problem underlying the invention is thus to provide a gear pump, in particular for medical purposes, which firstly is economical to manufacture and secondly has a high resistance to wear even in uses in which aggressive cleaning agents are employed.

By providing stationary spindles or axles for the pump wheels it is first achieved that in the gear pump according to the invention there are no bearings required for rotating shafts which are very prone to wear in particular when aggressive cleaning agents are employed. The gear pump according to the invention thus has the advantage that it can be used in fields in which the cleaning of the gear pump using aggressive media is essential and still has a high dependability because bearing wear cannot occur.

A further advantage of the gear pump according to the invention resides in that in the region between pump wheels and stationary axles by using suitable plastics no wear, or no appreciable wear, can occur and conse-

quently the problem of wear is not simply transferred from the mounting of the rotating shafts to the mounting of the pump wheels rotating on stationary spindles. Further investigations made within the scope of the invention have shown that the use of pump wheels consisting of plastic is certainly practicable even in the critical fields referred to, in particular medicine.

The combination of pump wheels consisting of plastic with stationary axles or spindles has the further advantage that no lubrication at all is necessary in the gear pump according to the invention because the plastic pump wheels have very good running properties making it possible to dispense with a lubrication.

By providing the hollow shaft connected on the one hand to the driving pump wheel and on the other to one of the magnets of the magnetic coupling it is achieved that a drive connection between the magnet and the driving pump wheel is possible although the driving pump wheel is disposed freely rotatably on a stationary axle. Another advantage is that in the region of the hollow shaft no appreciable wear occurs because the latter consists of a very resistant plastic with very good running properties.

Although it would be fundamentally conceivable to mount the pump wheel on a rotating shaft which consists of a corresponding plastic and from the good running properties of which at least a reduced wear in the region of the shaft bearings could be expected, it has been found that such a construction would lead to a pump wheel shaft which is too weak and flexible and consequently this construction does not appear suitable. Since the shaft which connects the driving pump wheel to the magnet in the gear pump according to the invention is made as hollow shaft rotating on the stationary axle, in the gear pump according to the invention no problems at all are encountered as regards flexibility because the hollow shaft can be supported over its entire length on the stationary axle and moreover has a substantially greater effective diameter than in the aforementioned fundamentally conceivable alternative of a rotating shaft with a diameter which would correspond approximately to the diameter of the axles of the gear pump according to the invention. Correspondingly larger dimensioning of such conceivable plastic shafts is not practicable because of the increased space required and the consequently greater overall size of the gear pump.

If the pump wheels and the hollow shaft in accordance with the advantageous development of this invention are made from polytetrafluoroethylene graphite particularly favorable running properties on the stationary journals are obtained and furthermore this material has proved resistant in particular to all media used in the field of dialysis.

The driving pump unit and the hollow shaft unit may be made integral which has advantages as regards the production. Of course, these two components of the gear pump according to the invention may also be connected together in a different manner should this be necessary for any desired reasons. Thus, the pump wheel and the hollow shaft could be connected together by means of a pin connection.

If the journal of the driven pump wheel is supported only in the cover plate of the pump housing the advantage is obtained that a further guide recess in the base plate of the pump housing can be dispensed with and this reduces the production expenditure. A one-sided mounting of the journal is possible in the gear pump